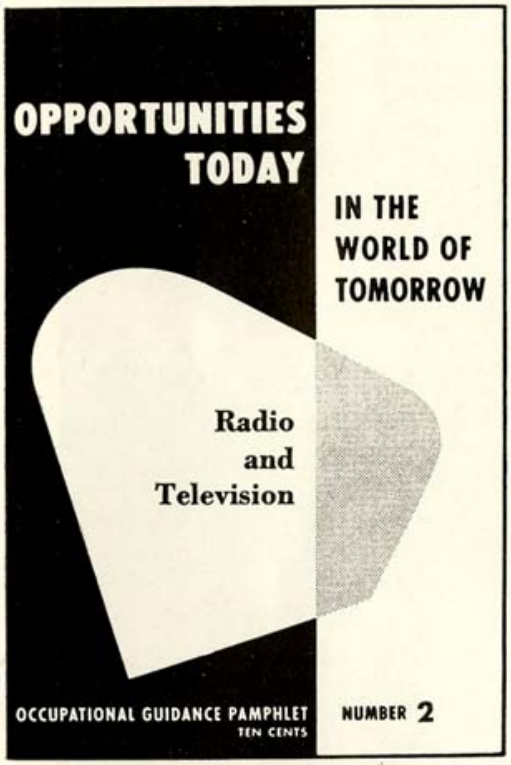
Designed for Guidance



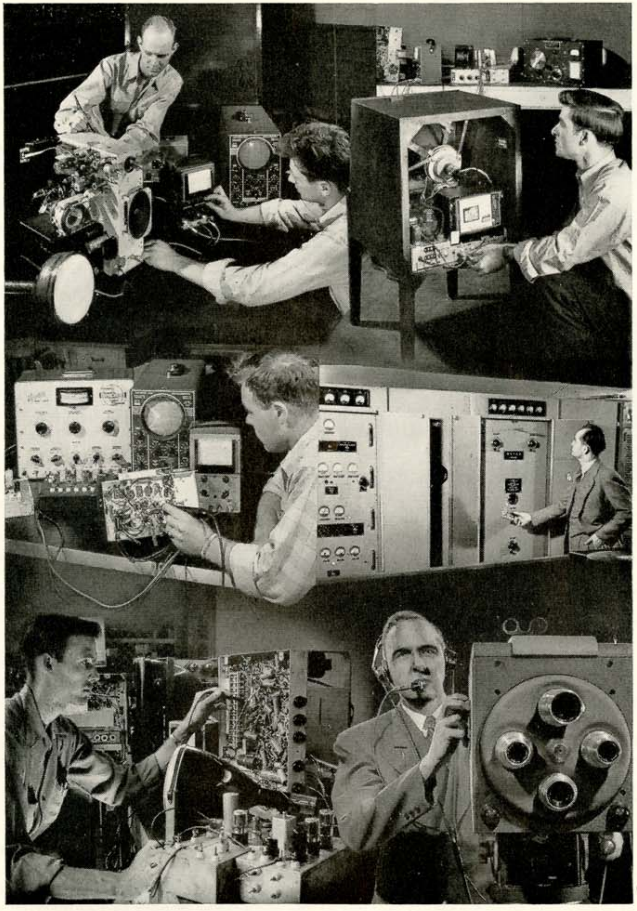
The Occupational Guidance Pamphlet on the following pages, dealing with the radio and television industry, is the second in a series published by the Milwaukee School of Engineering Reception of Occupational Guidance Pamphlet Number 1, "Refrigeration, Heating and Air Conditioning," by those in the fields of guidance and education, and by young men planning their careers, has been gratifying.

The favorable comments on the first guidance pamphlet, which was incorporated in the June, 1950 TRANSMITTER, have encouraged the various departments in the School to again cooperate in the production of another booklet of this nature. Occupational Guidance Pamphlet Number 2 is designed for the young man who is making a career decision, and, as in the case of the first publication, again presents a field of enterprise included in the School's curriculum.

These publications, however, are not only for the young man seeking a career. Since these descriptive brochures present a list of job potentials compiled through exhaustive research, they may also be of value to persons already established in the subject industries. The pamphlets may be instrumental in enlarging the horizons of these men by showing them the varied possibilities and opportunities in their field.

Each pamphlet is taken as a separate project, with the Industrial Advisory Committee from the subject field, the Admissions, Public Relations, and Relations with Industry Divisions all contributing to the planning and writing of the series. As the Industrial Advisory Committees are composed of leading executive personnel from Industry, the pamphlets are actually authoritative compendiums of the subject industry; designed to give the reader an impartial graphic presentation of the current field and its future.

Preparation of this Occupational Guidance Pamphlet was especially difficult because of the rapid expansion of the radio and television industry in this country. Statistical data contained in the pamphlets is in the main from United States Government Publications and authenticated market analysis periodicals. The occupations listed are among those in which Alumni of the Milwaukee School of Engineering are engaged; and, definitions of most occupational titles can be found in the 1949 Dictionary of Occupational Titles (Second Edition).



OCCUPATIONAL GUIDANCE PAMPHLET

Introduction

Radio and television comprise the bulk of the vast field of electronics. Radio, being the oldest branch, has found more diverse applications than has television at the moment. While the popular concept of the industry views it as an entertainment medium, the commercial and industrial applications account for the greatest revenue.

Television, on the other hand, is today's infant colossus of industry. Never before in the history of our country has an industry grown to such proportions in so short a span of time. This has been mainly due to the fact that TV was well developed before it was offered on the domestic market.

At present primarily an entertainment medium, it has, however, already developed some commercial applications. Used to instruct large groups of interns in surgery and medical practice, its future in the field of education can be tremendous. Where radio-active substances and intense heat do not permit the presence of the human body, TV becomes the technologist's 'eye' for close observation.

RADIO

In the early years of radio, sets could be constructed in the home workshop by any person reasonably handy with tools. Even the common five-tube superheterodyne was relatively simple to construct for the amateur craftsman. However, as the multi-tube sets became more popular, and with the addition of Frequency Modulation, radio construction and servicing grew away from the home workshop. Today the radio serviceman must have a solid technical knowledge to properly align and service the more complex radio sets now on the market. The higher frequencies of FM broadcasting pose many more technical problems in reception than confronted the old AM radio mechanic. FM is the connecting link between AM-radio and TV.

TELEVISION

The need for television servicemen today is equaled only by the same need when the first radios were marketed. The radio service technician has a foundation on which he may build the skill required in handling the new equipment needed in television service. But he will find that he needs a thorough review of many of the fundamentals which have become more critically important in television than they were in his experience with broadcast receivers. Half-way measures are as good as none in television servicing. Fundamental knowledge, based on a sound technical background, is a 'must'.

Yourself Incorporated

In selecting your occupational goal, you must be courageous and daring, but also practical. To be successful, you must feel that you are accomplishing the very utmost within your ability. You will not be able to do this unless your activities lie within the field where both your interest and aptitudes are in harmony. To help to analyze yourself, and as an aid in determining whether your interests and aptitudes lie within the technical field, the following analogy has been prepared.

YOURSELF INCORPORATED

The board of directors of a bank is constantly called upon to make decisions relative to the investment of the bank's capital. In a sense, you are like the board of directors of a bank; you are constantly investing your personal capital in your everyday life. Before you choose a career in radio and television, take stock of your capital — analyze your qualifications.

YOUR CAPITAL

C —The primary personal quality required of workers in this field, as in any other area of work, is an excellent *Character*. If you are honest and loyal, have respect for your fellow men, have initiative and resourcefulness, along with the willingness to accept responsibility, then you have the basic qualities needed for success in any industry.

A —Your interest in radio and television may be an indication of your *Aptitude* for this occupation. Other indications are the success you have in doing work analogous to that field. Your high school record, particularly in mathematics, physics, and shop is a fairly good barometer of your natural potentials.

P —In addition to an admirable character, you must have an acceptable *Personality* and have, or be determined to develop, a liking for people. Your duties will require you to work with your fellow employees, with your supervisors, in due time, with your own subordinates. Tact and courtesy are not uncommon traits, but they are two of the essential qualities in the make-up of the successful personality.

I —*Interest* in your work gives you satisfaction in its performance, stimulates you to continued effort, and promotes further study . . . all of which contribute to your success. If you are inquisitive as to the operation of electrical devices, you are exhibiting a fundamental requirement of a successful occupation as a radio-television technician.

T —Your previous education and *Training* is important in-as-much as it serves as a foundation upon which you can build your career. In many cases, your previous education is a factor in your choice of a career, but this need not be a controlling element. Many schools of higher learning have incorporated special programs designed to help the student meet technician level requirements.

A —You will achieve greater success in your work if it is an occupation that you are by nature capable of doing well; that is, if you have a natural talent for your chosen vocation. If you have been successful in your mathematics, physics, and chemistry in your preparatory school, in all probability you have the *Ability* to study a technical specialty, such as is radio or television. If you are clever with tools and have the knack of 'fixing things,' in all probability, you will make a good service technician.

L —*Language* is one asset of personal capital that is too often taken lightly. The art of rhetoric is an essential of success. No matter how able of mind, if one is unable to adequately express himself in both the written and spoken word, his achievement is limited. The technician, in order to comprehend engineering principles and to be able to express them graphically, must have command of the grammar and composition of engineering language.

Men in the technical field can be seen in the colorful garb of the construction boss, or in the svelte suit of the businessman. They can be found in the field supervising the construction of highways, buildings or bridges, or behind desks directing the technical phases of industry. They can be seen in the laboratory developing new products, machines, and processes, or in the manufacturing plant, devising the most efficient way to produce the product. In short, scientists, engineers, and technicians are essential to this technological world in which we live, and it is mainly through their activities and development that our high standard of living is made possible.

It must be remembered that servicemen, technicians, and craftsmen of all varieties are just as necessary to the world as are engineers, scientists, or other professional people. The individual is not only more contented but also a more valuable and more productive citizen when he is happily engaged in the life work for which his particular talents best suit him — regardless of the glamour and false pride superficially associated with "social position." Therefore, it should be the chief concern of the man considering the technical field as a career, to ascertain just where he fits in that field.

The Industrial Picture

The radio-television industry today embraces three interdependent branches, which employ technicians possessing widely varied abilities. These branches are:

1. Manufacturing and merchandising of transmitter and receiver apparatus.
2. Commercial communications.
3. Transmitting to the public.

MANUFACTURING AND MERCHANDISING

The manufacturing and merchandising branch deals with the manufacture, distribution and servicing of equipment used in the other two divisions. Basically, business is divided in two broad fields, manufacturing and retailing. In the conventional business pattern both of these fields are divided in nine traditional functions, plus management. As this booklet is not directed to an individual already in the field, we will skip over some of the important functions, such as record maintenance, product design, purchasing, personnel relations, public relations, finance and character, for the moment, and concentrate on production and sales, as they are the most likely places for a beginning.

PRODUCTION

In manufacturing, assembly, installation, and testing are usually assembly-line processes open to the semi-skilled service level individual. The more skilled technician finds his place in the experimental laboratories and engineering departments where his knowledge and skills may be put to direct use in a variety of ways, from model-making, testing and drafting to straight research work. Or, the skilled technician, after serving a period in the service level job may step into a foreman's or supervisory position.

To the retailer, production means the installation, service, maintenance and operation of manufactured equipment. The first step in this production process is called application engineering, particularly for the commercial and industrial applications. It involves selection of the kind and size of equipment best suited to the buyer's requirements. Installations require wiring diagrams,

physical layouts, and estimates of material and labor. It is one of the duties of the applications engineer to make these layouts and estimates. This phase of retailing belongs to the engineer and technician exclusively.

The related fields of installation and service likewise offer premiums for technical and engineering knowledge. Most manufacturers supply detailed instructions which can readily be interpreted by a trained man of ordinary intelligence. However, the rewards are always greatest for the men who know the job well enough to organize it properly, to execute it in a workmanlike manner, and to be sure that it operates as was intended by the engineers who designed and produced it.

A serviceman is one who is skilled in the art of repair and maintenance. His primary concern is to keep the apparatus in working condition, or if it fails, to see that it is soon in operating condition again. He can usually complete his training and be in a wage earning position within a year. The financial security is good, and there are many opportunities for the serviceman to become his own boss.

The technician is one who acts as a liaison agent with engineers. He is required to have a practical knowledge of scientific methods and practices so that he can understand the language of engineering and be able to interpret directions. The technical draftsman translates the engineer's sketches into blueprints; the technical assistant erects a working model; and the laboratory assistant aids the engineer or scientist in carrying out routine research duties. The technician, by the nature of his work, does not require the extensive education which the engineer does. Several times as many servicemen are needed as technicians, and several times as many technicians are needed by industry than engineers.

A man may launch his career in the television service field by first working as a *Television Installation Man.* He performs such duties as setting-up, installing, testing, and adjusting the television antenna and receiver in the customer's home or establishment, and explains the operation and the care of the set to the customer.

Maintenance service is a different matter. Relatively few of the users of electronic devices have the technical knowledge required to maintain and adjust them. Consequently, the satisfaction and safety of the user is dependent almost entirely upon the knowledge and skill of the men who service his equipment.

Radio Servicemen repair home and auto radios. In addition, they may also install and service other electronic equipment, such as inter-office communications and public address systems and warning devices. Sometimes radio repairmen sell and service other electrical appliances. A majority of those working on AM-FM sets are self-employed; some are employed by large repair shops, radio stores, garages, wholesale distributors, manufacturers of electronic equipment and other types of concerns.

The Television Service and Repairman also performs most of his duties at the

service shop. He assembles, tests, aligns, adjusts, and repairs the television receiver; duties which require a technical knowledge of television and a working knowledge of the complex test equipment used to intelligently service the set.

Many television technicians are employed by large companies to serve as assistants to engineers and scientists in experimental laboratories. Other television technicians find jobs in radio and television manufacturing plants which produce radio and television sets and equipment. These positions usually deal with the layout and supervision of production, and inspection and testing of manufactured equipment. These positions require men who have a mathematical and drafting background as well as a technical knowledge of the field.

SALES

Knowledge requirements for salesmen are similar to those of technicians. Both must know the operation of the apparatus with which they work. The technician must have a more detailed knowledge, but the salesman who begins with a technician's knowledge builds on a sound foundation. Research and production engineering are begun with the hope of making sales. There is no job anywhere for engineers, technicians, installers, or servicemen unless salesmen sell goods. Consequently, the rewards to successful salesmen are high, and many graduate into the ownership of their own businesses or into responsible positions in management.

MANAGEMENT

Every business you can name and every industry you can think of represents the development of an idea. Someone had courage to believe that he could make or sell goods or services which people want. The idea usually starts with a single individual who risks his savings and invests his time and effort in the project. When he begins to employ others to help him make and sell these goods and serve his customers, he becomes a manager, for it is management's job to establish the policies of the business, assign tasks to various employees, and see that said tasks are executed. To permit more rapid expansion, the businessman may persuade friends and others to invest their savings in his enterprise. He promises reasonable compensation for the use of their savings and for the risks they run. It is every man's desire to own his own business, to be his own 'boss'. While in the majority of cases the beginner does not start at the top by owning his business, such is not entirely impossible. Under favorable circumstances, many technically trained men, with only a minimum of work experience, have successfully started their own enterprises. This is particularly true in the small communities where there are few technically trained specialists.

COMMERCIAL COMMUNICATION

In aviation and the marine field, radio has become a fixture, not only in communications, but in navigation systems as well. The taxicab field has adapted radio for dispatching in most cities, while trucking and bus companies are also finding it useful. The FCC has opened space in the frequency spectrum to facilitate public safety radio services such as police, fire, forestry-conservation, state highway maintenance, and special emergency services which get 170 frequencies. Another large user of the two-way radio communications is the public utility industry.

TRANSMITTING TO THE PUBLIC

While it is the musician, the singer, the comedian, and the announcer who receive the applause of the listener, it is the technical man who keeps the program "on the air." In reality, the engineer is the key man in transmitting to the public — just as he is with the manufacturing division of the industry. Since these men contribute the "heart" of radio, it is well to have some understanding of the functions they perform.

The engineering set-up in a large studio is usually divided into groups; such as master control, studio engineering, field engineering, maintenance and construction, and transmitters. The staff of a large station averages close to 100 employees while a small station will employ about six workers.

OPERATING ENGINEER

A great proportion of the radio engineers in broadcast work are not actually working on radio, but are telephone engineers. Big city studios are usually in business districts, while the powerful transmitters are located outside the city and are connected by telephone lines. The engineers controlling the programs originating in the cities are engaged primarily in monitoring high fidelity telephone equipment and transmitting programs over thousands of miles of telephone circuits that carry them to the radio or television transmitters on the network.

RADIO AND TELEVISION OPERATOR

The bona fide operators in the group of radio engineers are the transmitter men who man the high power stations in the suburbs, checking and repairing high voltage equipment. They are usually recruited from previous service in maritime or commercial divisions, and are the only ones employed by the network who are required to be government-licensed radio engineers.

The broadcasting operators best known to the public are the studio operators who may be seen behind the glass partitions of the control room in the broadcasting station. Their duty is to achieve the timing, blending of voices, orchestra, and other sounds that go to make a perfect production. Operators in the communications branch of radio, point-to-point, maritime, and coastal services, are required to have government licenses, which are obtained through study and by passing an FCC examination satisfactorily. This is most easily accomplished by a planned course of study. Their duties are concerned solely with transcribing messages, photographs, etc., and the maintenance of equipment necessary for those duties.

The Outlook

With the nation's 'eyes' on television, quite naturally the question comes to mind as to what will happen to radio. It doesn't seem logical that radio will largely be replaced by television. The novelty in the newness of television has understandably lowered radio listening time. But in the home, the housewife most certainly cannot attend her household duties and watch television. As long as the quality of radio programs is upheld, it cannot help but maintain listenership. Commercially, radio will hold its own due to lack of necessity of television and the high cost of conversion. The services of FM are rapidly expanding in the mobile communications field to the point where its use is almost universal.

The Federal Communications Commission indicates that it will not be too long before there will be 200 to 300 television stations on the air, and it is estimated by responsible industrial sources that television in the next four years will require twice the labor capacity of present day radio and television.

A triumph of American ingenuity and productivity is the phenomenal progress which is now putting the modern miracle of television into millions of homes. The Radio Manufacturers' Association, now called the Radio, *Television*, Manufacturers' Association, reported that a total of 2,227,973 TV receivers were shipped by its members in 1949. This compares to a figure of 808,025 in 1948. As of February 1, 1950, nation-wide TV installations were reported at 4,374,000.

The biggest opportunity today is for the technically-trained television servicemen, as the most important national servicing problem we have is the need for more of these technicians. The Radio-Television Industry has grown so vast and has spread so quickly that there is a dire need for more competent men to take care of the millions of sets that are already in use — to say nothing of the additional millions to come.

Color television will add to the complexity of the present black and white TV set, thus increasing the TV service factor and opening additional opportunities for TV service technicians.

Each new station authorized to telecast by the FCC means more job opportunities in that area for trained television technicians. Now that television is here, ready at the turn of a dial to picture in the home everything worth seeing or knowing, it seems reasonable to expect that within ten years as many homes within signal areas will have television as have radio today.

No industry in our country has as bright a future as the Radio-Television Industry.

OCCUPATIONAL GUIDANCE PAMPHLET

Job Opportunities

The occupational chart on the following page has been prepared by the Milwaukee School of Engineering faculty to aid students in visualizing the occupations to which individuals may be promoted after a period of training and preparation.

Reading down from the top of the chart, there are listed occupational objectives corresponding to the level of study; namely, technician and engineering. The occupations listed are among those in which Alumni of the Milwaukee School of Engineering are engaged. Appearing to the right of the occupational titles are reference numbers as listed in the 1949 Dictionary of Occupational Titles (Second Edition) as published by the United States Government.

Due to the multitude of occupational opportunities that the Radio-Television Industry offers today, it would be impossible to give a complete listing in the space alloted. Those occupations shown are the most likely beginning positions in the industry. There are a score of positions open to the technician and engineer in the manufacturing phase of the industry alone; i. e., service manager, production manager, service engineer, sales, draftsman, safety engineer, supervisor in radio and television assembly, laboratory technician, etc.

The course given at the Milwaukee School of Engineering in Radio and Television prepares the graduate for those opportunities as are shown on the technician level. The course also prepares the student for examination for a Federal Communications Commission license to operate a broadcasting station. Upon satisfactory completion of the course most men enter the field, but those wishing to continue their education may do so by further study for an additional two calendar years in the College of Electrical Engineering of the School, earning a Bachelor of Science Degree in Electrical Engineering, electronics major. Thus he would be prepared for those occupational objectives as shown on the engineering level of the occupational chart.

Inasmuch as we are discussing "job opportunities," we cannot overlook another employer—our governmental agencies, in both civilian and national defense occupations. There are many opportunities awaiting the trained technician in the municipal, state and federal governmental agencies.

NUMBER TWO

OCCUPATIONAL CHART

Educational Advancement

Occupational Advancement

TECHNICIAN LEVEL

Radio and Television Technician
18 months total

Studio Engineer (radio broad)	DOT 0-61 40
Transmitter Technician (radio broad)	DOT 0-61 30
Television Service and Repairman (any ind)	DOT 5-83 416
Television Installation Man (any ind)	DOT 5-83.417
Radio Communication Maintenance Man (tel & tel)	DOT 5-83.446
Radio Research and Development Mechanic (tel & tel)	DOT 5-00.912
Radio Communication Technician (tel & tel)	DOT 5-83.445
Radio Interference Investigator (lt, ht, & power)	DOT 5-83.367
Electrician, Radio (any ind)	DOT 5-83.44
Radio Equipment Assembler (radio mfg)	DOT 4-98.050
Radio Mechanic (any ind) II	DOT 5-83.447
Radio Repairman (any ind) I	DOT 5-83.411

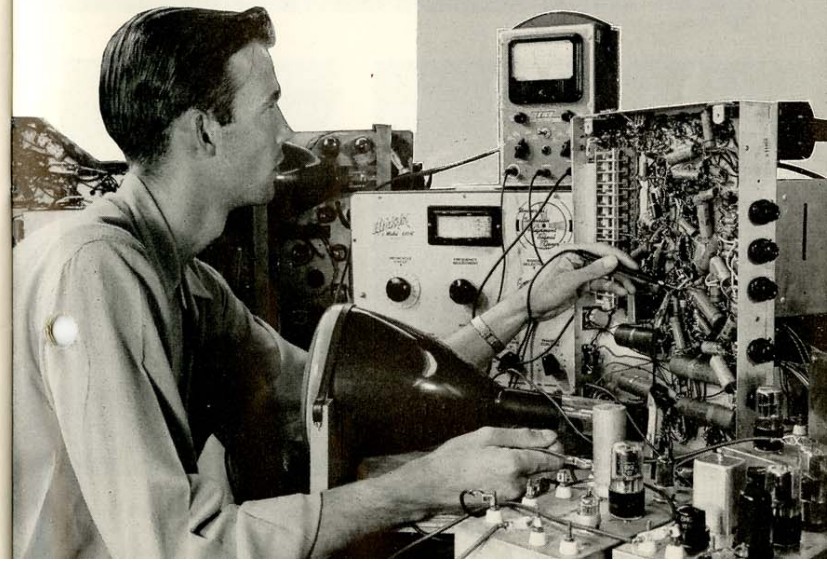
ENGINEERING LEVEL

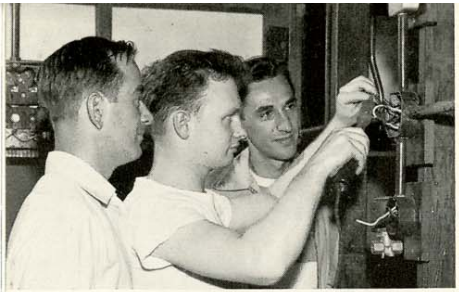
Electrical Engineering
3 years total

Radio Engineer (radio broad)	DOT 0-17.01
Audio Engineer (prof & kin)	DOT 0-17.01
Radio Television Design Engineer (prof & kin)	DOT 0-17.01
Radio Television Research Engineer (prof & kin)	DOT 0-17.01
Television Engineer (prof & kin)	DOT 0-17.01
Telephone Engineer (tel & tel)	DOT 0-17.01
Telegraph Engineer (tel & tel)	DOT 0-17.01
Transmission Engineer (tel & tel)	DOT 0-17.01

raining he V echnician

s is shown pictorially on the following pages, the Radio and Television curriculum at the Milwaukee School of Engineering not only gives the student a sound technical and practical education, but prepares him with the necessary knowledge of business and psychology to enable him to competitively take his place in today's rapidly expanding TV service field.



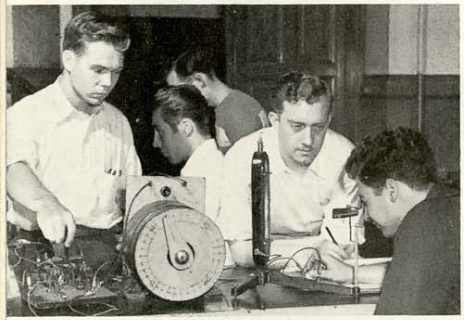


The first two terms of this course give the student a solid foundation in the fundamentals of electricity as well as the necessary mathematics and allied subjects upon which he will build his future studies.

1. In the Electrical Shop (01A) the student gains a practical knowledge of electrical wiring by making actual installations.

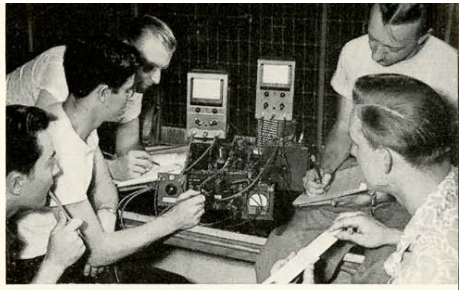
2. The fundamentals of electrical measurements in DC circuits are covered in the DC Circuits Laboratory through a carefully planned series of laboratory experiments.

3. The theory of AC circuits is proven in the AC Circuits Laboratory where students perform experiments illustrating the proper use of test equipment and efficient testing procedure.



4. In the interest of efficiency, ease and speed of calculation, the student is taught the use of the slide rule.

In his next two terms the student learns the principles of electronics and radio and enters radio servicing. He is learning the practical applications of theory through laboratory classes.

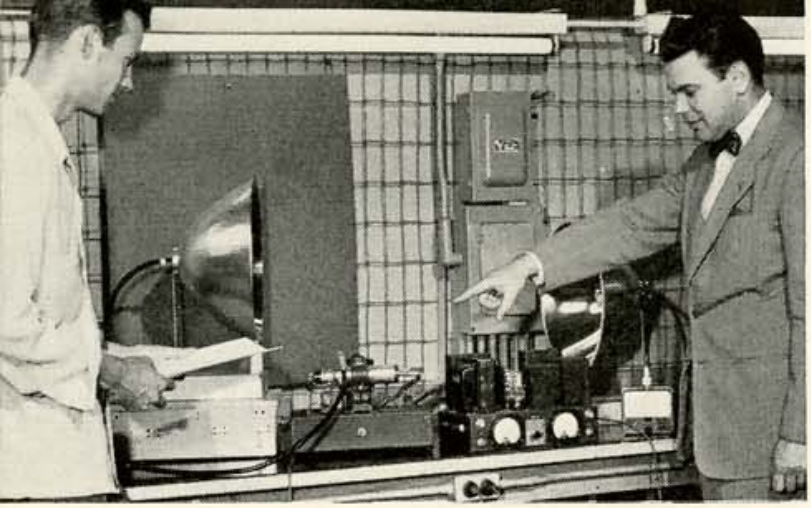


5. Here the students perform experiments illustrating the fundamentals of vacuum tube theory in the Electronics and Radio Laboratory (Eltn 43C).

6. Among the many duties of the technician in industry is that of reading and making engineering drawings. Shown here is an Engineering Drawing (Draft 43C) class of third term students.

7. Following the building of a five-tube superheterodyne AM receiver, the student learns the complete shop methods of radio servicing.

8. The significance of English as an important factor for success in industry is not overlooked. Expression in technical writing is stressed.



Nearing the completion of his course, the student is now concerned with AM transmitters and FCC regulations, Ultra-high frequency equipment and control room and studio procedures. His last term is spent in the precise theory and servicing of FM and TV receivers.

▲ 9. Many critical factors enter the work with Ultra-high frequencies that were not present in the study of the lower frequencies. Here the student learns UHF techniques.

10. In Industrial Organization (1 Com 20A) the student learns the organization pattern of business and the importance of the individual in business. ▶

11. To properly understand television, a knowledge of the characteristics of light and sound is essential. Here students in the Physics of Light and Sound Laboratory (Phy 43C) are shown using the spectrograph. ▼

12. Through the study of component units of the TV receiver, the student learns the alignment and servicing techniques of commercial television receivers. ▶